WASTEWATER TREATMENT HISTORY AND FUTURE PLANS

THE CITY OF manistee MICHIGAN

HISTORY OF SYSTEM

HOW DID THE CITY OF MANISTEE'S WASTEWATER SYSTEM DEVELOP?

1880's – 1920's

The original wastewater collection system in the City of Manistee was constructed in the 1880's and consisted of open ditches that transported stormwater mixed with sanitary wastewater from homes and businesses directly into the Manistee River and Manistee Lake. These ditches were eventually replaced with pipes, but the stormwater and wastewater mix continued to discharge untreated directly into the river and lake. These sewer pipes are referred to as combined sewers since they transport both stormwater and wastewater in the same pipe.

1930's

The wastewater treatment plant (WWTP) was designed and constructed to treat wastewater collected from the City. To convey the wastewater to the WWTP, an interceptor sewer pipe was constructed along the Manistee River to collect the stormwater and wastewater from the sewer pipes that were discharging directly into the river. The WWTP and interceptor sewer were designed to handle the City's wastewater during dry periods. It was impractical and too costly to design the WWTP and interceptor sewer to handle both wastewater and all the stormwater flows. Therefore, Combined Sewer Overflow (CSO) structures were constructed where the new interceptor sewer was connected to the existing combined sewers. During wet weather events, the CSO structures were designed to overflow excess combined sewer flow into the Manistee River or Manistee Lake to keep from overwhelming the WWTP and interceptor sewer. Figure 1 shows the approximate location of these CSOs with green markers.

Figure 1. 1932 Interceptor Sewer - CSOs Installed.

1940's – 1970's

After the completion of the WWTP and the CSO structures, the City's combined sewer collection system continued to expand with the continued growth of the City. Additional pipes, manholes, pump stations, and force mains were added increasing the overall area served by the WWTP.

1970's – 2010's

In the 1970's the City began the process of separating the combined sewer system into separate piping systems that included one system for sanitary wastewater and one for stormwater. In most cases, the City installed a new pipe that became the new storm sewer, and the original sewer pipe then became the dedicated sanitary sewer. The separation of the stormwater from the system resulted in the elimination of CSO structures. By 2012, the City separated its last combined sewer and only had one remaining overflow structure at the intersection of 5th and Ramsdell Streets. This structure is now referred to as a sanitary sewer overflow (SSO 018) since the stormwater has been separated out.

WHY DOES WASTEWATER CONTINUE TO DISCHARGE INTO MANISTEE LAKE?

After completion of the separation projects in 2012, it was determined the system was still seeing high flowrates during wet weather events, like heavy rain and spring snowmelt, at the WWTP and at the SSO 018 structure resulting in overflows to the lake.

Infiltration

The pipes, manholes and pump stations of the current sanitary sewer system, some of which are over 100 years old, have aged to the point that they are allowing large amounts of groundwater to seep in through cracks and joints. This seepage is known as infiltration. Infiltration is worsened by the high water table we are currently experiencing. This infiltration is a constant flow into the system, takes away from the available capacity of the sanitary sewers and the treatment capacity at the WWTP, and increases operating costs. Infiltration comes from both the public portions of the system (old sewers, wet wells, and manholes) and from private sources (old sanitary sewer leads, connections to footing drains, etc.).

Inflow

Inflow is another significant problem that is associated with the age of the system. Inflow is direct connections to the sanitary sewer system from non-wastewater sources such as catch basins, yard drains, roof drains, footing drains, and sump pump leads. Water originating from inflow sources during storm events is almost immediately seen within the collection system and at the WWTP. These sources are harder to locate, have a much greater impact on peak flows during wet weather conditions and are very expensive to correct. Inflow sources are the primary cause of Sanitary Sewer Overflows (SSO) within the City of Manistee. Inflow sources are both publicly and privately owned. Much work has been done to eliminate sources of inflow such as eliminating cross connections, removing roofing drains, and lining sewers. Despite these efforts, inflow remains a significant problem.

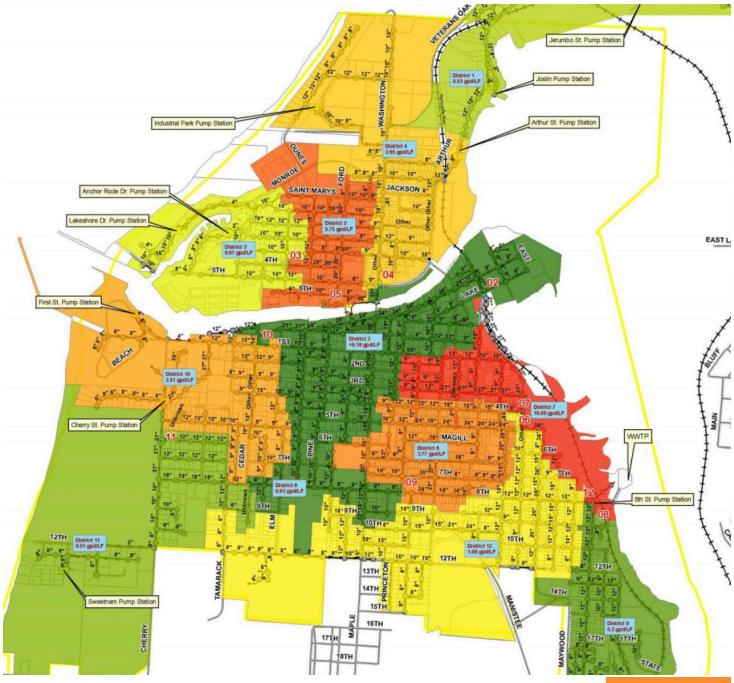

Figure 2.

The combined impacts of excess Infiltration and Inflow (I&I) results in reductions in sewer and WWTP capacity, increased SSO event frequency, and have financial impacts on the system. Even though the normal wastewater is highly diluted (up to 80%) by I&I, the mixture is considered wastewater, and all flows to the WWTP need to be processed as if it is wastewater. This results in additional costs for treating non-wastewater flows.

WHERE IN THE CITY IS I&I COMING FROM?

Beginning in 2015, the City utilized flow meters strategically placed within the sewer collection system to help determine the areas with the highest rates of I&I. Figure 2 illustrates areas within the City and their relative I&I contributions. The locations with the lightest color tones (greens and yellow) contribute less I&I. The locations with the darkest color tones (orange and red) contribute higher rates of I&I.

Due to the continued high rates of I&I in the City's wastewater collection system, especially during wet weather events, the system sees flows that exceed the capacity of the sanitary sewers and the capacity of the WWTP. When these capacities are exceeded, the excess water is released at SSO 018 to relieve the pressure on the system, resulting in an SSO event. SSO 018 essentially functions as a pressure relief valve on the system protecting existing infrastructure and private properties by preventing sewer backups during wet weather events.

WHY NOT JUST PLUG SSO 018 TO PREVENT THESE OVERFLOWS?

The City has not been able to abandon SSO 18 because it serves as the only relief point upstream of the WWTP. Removing SSO 018 before reducing or storing excess I&I or increasing the capacity at the WWTP would result in overloading the sewer system causing basement flooding and overloading the WWTP causing sewage to discharge into the lake without full treatment. Figure 3 summarizes the impacts of immediately removing SSO 018 prior to reducing I&I into the existing sanitary sewer system. Locations highlighted in brown on the map would likely experience basement flooding during a wet weather event if SSO 018 was not operational to relieve pressure on the system.

Figure 3.

WHY HAS IT TAKEN SO LONG TO FIX THE PROBLEM AND WHEN WILL IT BE COMPLETED?

The City has worked with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) over the past 40 years to separate the extensive combined sewer systems and has eliminated all of the CSOs except SSO 018. The volumes of the overflows have been significantly reduced in the past 20 years while staying in compliance with the State and Federal regulations.

SSO 018 cannot simply be removed or plugged. There is significant risk to public infrastructure and private property if SSO 018 is removed without first managing I&I. Reducing and/or managing I&I is an expensive and complicated problem to resolve since it is difficult to identify at the source, and it originates from both public and private sources. Working with EGLE, several investigations, studies, and plans have been completed to identify the condition of the City's wastewater infrastructure.

The City's most recently approved discharge permit for the WWTP includes a Wet Weather Corrective Action Plan (WWCAP) which provides deadlines for key milestones to be met as part of eliminating SSO 018. The City has met all the deadlines identified in the WWCAP to date. Phase I of the project to eliminate SSO 018 is under construction now. Phase II of the project is in the final permitting and funding stages and will be under construction later this year with an anticipated completion date at the end of 2021.

Even though Phase I construction will be completed, and Phase II construction will be underway, the overall WWCAP deadline to complete construction of the entire project by November 1, 2020 will not be met. Regular meetings and correspondence with EGLE are on-going to keep them informed of the project's funding schedule and its impacts on the WWCAP deadline, including the anticipated construction completion date at the end of 2021.

WHAT IS BEING DONE TO FIX THE PROBLEM AND HOW MUCH WILL IT COST?

The proposed project is being constructed in two phases for permitting and funding reasons. Phase I consists of two contracts that are currently under construction and will work to reduce I&I. The first contract involves coating the inside of sewer pipes and manholes with plastic liners to reduce leaking and make them stronger. Approximately 5.5 miles of pipe and 80 manholes will be rehabilitated this way.

The second contract in Phase I will address areas that experience localized flooding and currently have no stormwater outlets. By adding a stormwater system to service these areas, the I&I on the sanitary sewer will be reduced thus cutting the amount of water entering the WWTP. The new storm sewers will also provide an outlet for private and public source of inflow. Spot repairs of broken and collapsed sanitary sewers will also be completed as part of the project to eliminate direct I&I into the system. The project will include 3,900 feet of storm sewer and roadway improvements and 900 feet of watermain improvements on the northside of the City. This phase is being funded by a Rural Development loan and has an estimated overall project cost of $4.7M.

Once Phase I has addressed I&I, Phase II will focus on removing SSO 018. Phase II also consists of two contracts. The first contract includes the construction of 2,500 feet of 48-inch-diameter sanitary sewer pipe that will have sufficient capacity to convey wastewater to the WWTP during both dry and wet weather. All impacted streets will be reconstructed, and 2,100 feet of water main will be replaced.

The second contract in Phase II consists of construction at the WWTP including a new headworks building with new wet and dry weather pumps, new wet and dry weather screens, and a grit removal system. When flows exceed what the WWTP can handle, the excess wastewater will flow through a wet-weather screen and be pumped into three new above-ground storage tanks that can hold approximately 6.0 million gallons. Flowing through the tanks will allow for additional settling to clean the water. When the flows to the WWTP normalize, the stored wastewater will flow back into the plant at a controlled rate that will allow for proper treatment. The WWTP will be renamed the Manistee Clean Water Recovery Facility to reflect its new capabilities.

Though rare, there will be future storm events that exceed the regulated design volume of the tanks. During these rare events, in addition to the initial screening and settling the wastewater will receive in the headworks building and tanks, the diluted wastewater will be disinfected with chlorine prior to discharging into Manistee Lake. This process of screening, settling, disinfecting, and discharging to Manistee Lake for events exceeding the design event has been discussed with EGLE and would not be considered a violation of the City's discharge permit for the WWTP. Without the ability to provide for this rare discharge, there would be backups into basements and impacts to flooding at the WWTP. This type of design is commonly in use across the State and strikes a balance between protecting the environment, meeting permit requirements, and limiting impacts to residents' sewer rates.

Figure 4.

Figure 4 shows the location of the proposed 48-inch sanitary sewer in yellow and the location of the proposed headworks building (rectangle) and storage tanks (circles) in red. Phase II is being funded with a Rural Development loan and grant and has an estimated overall project cost of $18.0M, and the intent is for the project to be completed by the end of 2021.

WILL MY SEWER BILL GO UP?

All projects outlined above have been, or will be, funded by USDA Rural Development. Most of the funding will be in the form of a low-interest loan with a 40-year term. The remaining funding will be in the form of a grant for approximately $4.0M. Rural Development Funding of the Phase I projects has been acquired. The Phase II Rural Development loans and grant application have been approved on a local basis and are undergoing review at the national level.

The loans will not result in a significant increase in annual payments by the City due to their anticipated interest rates, 40-year term, and a historical sewer bond being paid off. At this time, it is not anticipated rates will significantly vary from the current annual rate increase of 3.5% identified in the last rate study.